GUAM AGRICULTURAL EXPERIMENT STATION
ISLAND OF GUAM
Under the supervision of the
UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 5

EFFECT OF TIME OF PLANTING AND FERTILIZERS ON THE YIELD OF VEGETABLES

BY

GLEN BRIGGS, Agronomist

Issued February, 1926

WASHINGTON
GOVERNMENT PRINTING OFFICE
1926

GUAM AGRICULTURAL EXPERIMENT STATION, ISLAND OF GUAM

[Under the supervision of the Office of Experiment Stations, United States Department of Agriculture]

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CONTENTS

The Guam Agricultural Experiment Station began experiments in 1910 to determine the adaptation of certain introduced vegetables to soil and climatic conditions, the best time of planting both native and introduced sorts for quantity and for quality, the effect of fertilizers and the time and rate of application on yield, and the effects of shading certain vegetables.

TIME OF PLANTING

Very little definite information is available concerning either the proper time or the proper methods of planting in Guam; and as a result many of the farmers and gardeners, after making a few unsuccessful attempts to grow vegetables, become discouraged and abandon all further effort. Failure is usually due to planting at the wrong time, or to neglecting to apply the proper fertilizers at the right time.

It would seem that vegetables should grow well the year round in Guam, where the climate is strictly tropical in nature. Most of the common vegetables do grow to a greater or less extent during any part of the year; but they do better in some months than in others, production being largely influenced by climatic changes, which are either detrimental to plant growth or cause the plants to make excessive growth.

The dry season generally extends from November to June, and the rainy season from July to October. The amount of rain that falls varies from an average of less than 3 inches in the driest month to almost 25 inches in the wettest month. Variation in temperature at certain times causes a cool and a hot season, neither of which exactly

[1] Resigned, effective June 6, 1921.

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agrees with the time of heavy and light rainfall. The cool season occurs during the latter part of the rainy season, or soon afterwards.

The station has conducted experiments in vegetable growing through all the variations in rainfall and temperature and has determined fairly well the best time of planting and the most favorable seasons for the different kinds of vegetables. Plantings have been made every month when possible and more frequently in some cases. In nearly all tests plantings that were made during the extremely dry season and during periods of excessive rain failed. Cucumbers proved to be an exception and yielded large crops during the rainy season. The experiments were conducted on a low, heavy clay soil that is similar to much of the lowland area of the island. Doubtless this soil could be greatly improved by the addition of organic matter and green manure and by being better drained than it now is.

FERTILIZERS

If the soil is not naturally fertile, it must be made so by the addition of fertilizer. A fertilizer may be said to be anything that improves the crop-producing capacity of the soil. A complete fertilizer is one containing the three essential elements nitrogen, phosphorus, and potassium.[2] With proper cultivation and applications of fertilizer and manure, very poor soils may be made to produce large and profitable yields. The effect of fertilizer on crop yield should be more than enough to compensate for the cost of the fertilizers applied; that is, the crop produced should bring a profit on the money invested.

In much of the station's work with vegetables, duplicate plats were used, one being treated with commercial fertilizers and the other left to serve as a check plat. This was done to determine the general effect of fertilizers on the yields of vegetables and also to learn the need of the soils. Where not otherwise specified in this bulletin, the fertilized plats were treated with a complete fertilizer containing 85 pounds of nitrogen, 145 pounds of phosphoric acid, and 200 pounds of potash per ton. This was applied broadcast at the rate of 1,000 pounds per acre, and then worked well into the soil previous to planting the seed. In other words, the fertilizers were applied at the approximate rates of 265 pounds of sodium nitrate (containing 16 per cent nitrogen), 495 pounds of acid phosphate (containing 15 per cent phosphoric acid), and 240 pounds of potassium sulphate (containing 42 per cent potash) per acre.

DETAILED EXPERIMENTAL DATA

This bulletin gives in some detail the results of six years' experiments (1915 to 1920, inclusive) on time of planting and use of fertilizers.

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[2] The nitrogen in fertilizer is usually derived from such substances as sodium nitrate, ammonium sulphate, tankage, or dried blood; potassium from potassium salts, mainly sulphate or muriate; and phosphorus from rock phosphates, phosphatic slag, and bone. The rock phosphate is insoluble and is usually treated with sulphuric acid to make it available for the use of plants. Phosphate so treated is known as acid phosphate.

Kentucky Wonder Bean (*Phaseolus* sp.)

The native ranchers of Guam are particularly partial to the Kentucky Wonder bean because of its ease of growth, prolificacy, and long period of production.

Time of planting tests.—In 109 tests covering a period of five years through both the wet and the dry season the Kentucky Wonder bean produced, on the average, during a period of 21.02 days. The average length of time the crops occupied the ground was 78.35 days, and the average length of time from planting to first harvest was 57.33 days. From the unfertilized plats the highest yields were obtained from plantings made during May, February, December, and March, respectively, and the lowest yields were obtained from plantings made in June, July, August, and April. The months first mentioned may be considered the most favorable for planting for high yields. June, July, and August being very wet, and April very dry, are the most unfavorable months for growing beans. In the fertilized plats the four most favorable months for planting were October, May, March, and November, in the order named, and the lowest yields were obtained from plantings made in February, June, July, and August, respectively. The average yield from the unfertilized plats was 2,609.19 pounds of green snap beans per acre, and from the fertilized plats 3,595.7 pounds per acre. The effect of the fertilizers was evident not only in the increased yields, but also in most cases in the change they brought about in the averages for the most favorable months for planting. Table 1 gives the results of the tests.

TABLE 1.—*Results of monthly plantings of Kentucky Wonder beans on fertilized and unfertilized soils*

Month planted	Fertilized area		Unfertilized area	
	Number of tests	Average weight of string beans per acre	Number of tests	Average weight of string beans per acre
		Pounds		*Pounds*
January	3	2,554.17	6	1,766.67
February	2	1,606.25	4	3,679.18
March	5	4,576.20	6	2,968.84
April	2	2,612.50	3	1,491.67
May	6	5,237.50	11	4,080.69
June	2	1,662.50	2	850.00
July	3	1,987.50	8	1,182.04
August	3	2,383.33	3	1,379.17
September	5	3,637.70	6	2,545.67
October	4	5,418.75	8	2,435.94
November	4	3,818.75	4	2,598.38
December	3	3,012.50	6	3,645.83
Average	----------	3,595.70	----------	2,609.19

Tests of fertilizers.—Fertilizers very materially increased the yield of string beans in nearly all tests. Table 2 gives the effect of fertilizers on the yield in nine tests:

TABLE 2.—*Effect of fertilizers on Kentucky Wonder beans planted at different dates* [1]

Plat No.	Fertilizer treatment per acre	Yield per acre									Average yield per acre
		Test No. 2	Test No. 3	Test No. 4	Test No. 5	Test No. 6	Test No. 7	Test No. 8	Test No. 9	Test No. 10	
		Lbs.[2]	*Lbs.*[3]	*Lbs.*[4]	*Lbs.*[5]	*Lbs.*[6]	*Lbs.*[7]	*Lbs.*[8]	*Lbs.*[9]	*Lbs.*[10]	*Lbs.*
1	No fertilizer (check plat)	168.3	1,025.0	2,175.0	4,025.0	375.0	3,225.0	2,437.5	1,050.0	812.5	1,699.3
2	Sodium nitrate, 250 pounds	787.5	2,300.0	4,150.0	9,012.5	3,000.0	5,487.5	4,275.0	2,150.0	6,312.5	4,163.9
3	Acid phosphate, 625 pounds	1,218.8	2,512.5	4,200.0	9,037.5	4,750.0	4,675.0	4,712.5	1,637.5	7,125.0	4,429.9
4	Potassium sulphate, 270 pounds	1,937.5	1,400.0	2,687.5	7,462.5	3,600.0	5,225.0	3,925.0	1,850.0	6,812.5	3,877.8
5	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds	3,031.3	3,512.5	4,600.0	11,800.0	7,900.0	7,212.5	3,412.5	3,612.5	6,187.5	5,696.5
6	No fertilizer (check plat)	2,118.8	2,637.5	3,900.0	6,787.5	4,262.5	6,600.0	4,150.0	1,512.5	7,200.0	4,352.1
7	Sodium nitrate, 250 pounds; potassium sulphate, 270 pounds	2,125.0	2,962.5	5,737.5	5,700.0	5,125.0	7,512.5	3,100.0	1,662.5	7,462.5	4,598.6
8	Acid phosphate, 625 pounds; potassium sulphate, 270 pounds	3,143.8	3,400.0	4,825.0	5,637.5	5,987.5	8,750.0	3,225.0	3,225.0	5,037.5	4,803.5
9	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds; potassium sulphate, 270 pounds	5,306.6	3,475.0	7,100.0	13,637.5	9,312.5	7,600.0	2,650.0	2,650.0	5,250.0	6,331.3
10	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds; potassium sulphate, 270 pounds (one-half applied before planting and one-half one week after planting)	3,950.0	5,337.5	6,350.0	12,037.5	8,850.0	6,025.0	3,412.5	3,412.5	6,212.5	6,176.4
	Average yield per test	2,378.8	2,856.3	4,572.5	8,513.8	5,316.3	6,231.3	3,530.0	2,276.3	5,841.3	------

[1] Test No. 1 destroyed by heavy rains immediately after beans were planted.
[2] Planted Jan. 13, 1917; first harvest, Mar. 3, 1917; last harvest, Apr. 10, 1917.
[3] Planted July 13, 1917; first harvest, Sept. 1, 1917; last harvest, Sept. 27. 1917.
[4] Planted Oct. 12, 1917; first harvest, Dec. 3, 1917; last harvest, Dec. 19, 1917.
[5] Planted Dec. 24, 1917; first harvest, Feb. 15, 1918; last harvest, Mar. 4, 1918.
[6] Planted Mar. 19, 1918; first harvest, May 10, 1918; last harvest, May 23, 1918.
[7] Planted Feb. 7, 1919; first harvest, Apr. 9, 1919; last harvest, Apr. 28, 1919.
[8] Planted May 23, 1919; first harvest, July 28, 1919; last harvest, Aug. 18, 1919.
[9] Planted Sept. 20, 1919; first harvest, Oct. 13, 1919; last harvest, Nov. 24, 1919.
[10] Planted Nov. 21, 1919; first harvest, Jan. 12, 1920; last harvest, Jan. 30, 1920.

The averages for the fertilizer tests differed greatly, but the highest yields were obtained from plantings made during months that in other tests were found to be most unfavorable for growth. The plats which were treated with acid phosphate, both singly and in combination with other fertilizers, responded better than did the other plats; and the plats that were treated with sodium nitrate and acid phosphate made the most economical gains in all the tests.

Table 3 shows the effect of fertilizers on the value of average yield of Kentucky Wonder beans of the nine preceding tests.

TABLE 3.—*Value of increase in yield of Kentucky Wonder beans due to fertilizers*

Plat No.	Fertilizer treatment per acre	Average yield of beans per acre	Cost of fertilizers [1]	Value of beans [2]	Value of beans less cost of fertilizers	Value of increase due to fertilizers
		Pounds				
1	No fertilizer (check plat)	1,699.3	----------	$50.98	$50.98	----------
2	Sodium nitrate, 250 pounds	4,163.9	$10.00	124.92	114.92	$24.15
3	Acid phosphate, 625 pounds	4,429.9	12.50	132.90	120.40	29.63
4	Potassium sulphate, 270 pounds	3,877.8	29.70	116.33	86.63	—4.14
5	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds	5,696.5	22.50	170.90	148.40	57.63
6	No fertilizer (check plat)	4,352.1	----------	130.56	130.56	----------
7	Sodium nitrate, 250 pounds; potassium sulphate, 270 pounds	4,598.6	39.70	137.96	98.26	7.49
8	Acid phosphate, 625 pounds; potassium sulphate, 270 pounds	4,803.5	42.20	144.11	101.91	11.14
9	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds; potassium sulphate, 270 pounds	6,331.3	52.20	189.94	137.74	46.97
10	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds; potassium sulphate, 270 pounds (one-half applied before and one-half applied one week after planting)	6,176.4	52.20	185.29	133.09	42.32

[1] In Guam sodium nitrate costs 4 cents a pound, acid phosphate, 2 cents a pound, and potassium sulphate, 11 cents a pound. These figures are based on the average amount paid during the period 1914–1918, when most of the potassium sulphate was brought in.

[2] The value of the beans is based on the price paid for string beans at the local market, or 3 cents a pound.

It should be borne in mind that the values in Table 3 do not include the cost of applying the fertilizers, nor the cost of extra labor employed in harvesting or marketing the increased yield of beans. This difference is amply compensated for, however, in the finer quality of beans obtained from the fertilized area. The values are based on the average of the two check plats and any difference above or below is credited to the effect of the fertilizers. Although the highest yields were obtained from plats Nos. 9 and 10, the greatest profit was made from plat No. 5, to which only sodium nitrate and acid phosphate had been applied. The plats receiving an application of potassium sulphate only showed a loss of $4.14 per acre in the final accounting.

Direct comparisons of the fertilized and unfertilized plats showed in 40 tests that the former yielded at the average rate of 3,679.5 pounds per acre, and the latter at the rate of 2,188.5 pounds per acre. The fertilizers cost at the rate of $46.90 per acre, and the beans were valued at $110.39 and $65.55, respectively. When the initial cost of the fertilizer was taken into account, the fertilized beans lacked $2.06 per acre of being as valuable as the unfertilized beans. These results would seem to indicate that too much potassium sulphate and not enough acid phosphate had been used to secure the highest yield of Kentucky Wonder beans.

LIMA BEANS (*Phaseolus lunatus*)

Of all the varieties of Lima beans tested at the station, Henderson's Bush has given the most satisfaction, producing a high yield of beans of fine quality during periods of little rain.

Time of planting tests.—Data obtained in 40 tests showed that Lima beans continued to produce on an average of 84 days after the first harvest, and that the plantings each occupied the ground on an average of 164 days, or about 5½ months. The average length of time from planting to first harvest was 80 days.

In 48 tests covering a period of five years, yields from unfertilized land have ranged from 675 to as high as 10,250 pounds of beans per acre. Time of planting tests have shown that certain months are more favorable than others for planting to obtain large yields. The most favorable months were November, October, June, and September, in the order named, and the most unfavorable months were April, March, August, and July, respectively. By selecting a good location and by giving the crop proper management and care, however, it is thought that beans can be grown in even the most unfavorable seasons in Guam. Table 4 shows the effect of time of planting on yield of Lima beans.

TABLE 4.—*Effect of time of planting on yield of bush Lima beans*

Month planted	Number of tests	Average yield per acre	Month planted	Number of tests	Average yield per acre
		Pounds			*Pounds*
January	6	2,926.57	August	4	1,206.20
February	2	2,106.25	September	2	3,175.00
March	3	1,018.33	October	7	4,981.14
April	2	875.00	November	5	5,311.76
May	5	1,847.50	December	3	2,741.67
June	3	3,743.67			
July	6	1,547.52	Average		2,857.85

On the fertilized plats the highest average yields were obtained from plantings made during October, December, November, and June, in the order named, and the lowest from those made in March, August, May, and April, respectively. On the unfertilized plats the highest yields were obtained from plantings made during October, November, June, and September, in the order named, and the lowest from those made in April, March, August, and May, respectively. Table 5 compares the difference in yield between fertilized and unfertilized plats for each month of the year.

TABLE 5.—*Effect of time of planting on yield of bush Lima beans on fertilized and unfertilized plats*

Month planted	Number of tests	Average yield per acre from fertilized plats	Average yield per acre from unfertilized plats	Month planted	Number of tests	Average yield per acre from fertilized plats	Average yield per acre from unfertilized plats
		Pounds	*Pounds*			*Pounds*	*Pounds*
January	3	3,958.33	2,712.50	August	2	2,281.00	1,415.50
February	1	4,625.00	3,150.00	September	2	4,175.00	3,175.00
March	1	2,275.00	1,250.00	October	6	6,875.00	5,811.33
April	2	3,150.00	875.00	November	4	5,767.00	5,768.88
May	5	3,077.50	1,847.50	December	3	5,983.33	2,741.67
June	2	5,154.00	4,090.50				
July	3	3,639.50	2,493.50	Average		4,613.79	3,368.71

Tests of fertilizers.—The quantity and kind of fertilizers to be applied to Lima beans will depend upon the needs of the soil, which may vary for the different farms. Most soils are benefited by the application of barnyard manure. Although the bean plant is a legume and gathers nitrogen from the air, it can be benefited by applying sodium nitrate to the soil in which it is grown. Five tests were conducted with sodium nitrate, acid phosphate, and potassium sulphate, both singly and in combination, to determine their effect on the yield of bean. The results are given in Table 6.

TABLE 6.—*Effect of time of planting and kind of fertilizers on yield of Lima beans*

Plat No.	Fertilizer treatment per acre	Yield per acre in—					Average yield of each plat
		Test No. 1	Test No. 2	Test No. 3	Test No. 4	Test No. 5	
		Pounds [1]	*Pounds* [2]	*Pounds* [3]	*Pounds* [4]	*Pounds* [5]	*Pounds*
1	No fertilizer (check plat)	2,317.80	2,400.00	7,287.50	362.50	500.00	2,573.56
2	Sodium nitrate, 250 pounds	3,468.80	3,937.50	7,537.50	450.00	887.50	3,256.26
3	Acid phosphate, 625 pounds	3,212.50	3,637.50	6,937.50	1,787.50	262.50	3,167.50
4	Potassium sulphate, 270 pounds	3,182.20	4,462.50	6,725.00	2,625.00	1,950.00	3,788.94
5	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds	3,443.80	3,600.00	5,800.00	3,775.00	675.00	3,458.76
6	No fertilizer (check plat)	2,106.20	2,362.50	7,137.50	2,675.00	962.50	3,048.74
7	Sodium nitrate, 250 pounds; potassium sulphate, 270 pounds	3,400.00	2,000.00	6,737.50	3,250.00	687.50	3,215.00
8	Acid phosphate, 625 pounds; potassium sulphate, 270 pounds	3,250.00	2,837.50	5,962.50	2,887.50	537.50	3,095.00
9	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds; potassium sulphate, 270 pounds	3,531.20	2,637.50	7,025.00	1,362.50	900.00	3,091.24
10	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds; potassium sulphate, 270 pounds (one-half applied before and one-half applied one week after planting)	3,387.50	2,687.50	6,025.00	800.00	750.00	2,730.00
	Average yield per test	3,130.00	3,056.25	6,717.50	1,997.50	811.25	3,142.50

[1] Planted Jan. 13, 1917; first harvest, Mar. 9, 1917; last harvest, Apr. 10, 1917.
[2] Planted July 12, 1917; first harvest, Sept. 13, 1917; last harvest, Sept. 24, 1917.
[3] Planted Nov. 23, 1917; first harvest, Jan. 31, 1918; last harvest, May 6, 1918.
[4] Planted Feb. 6, 1919; first harvest, Apr. 26, 1919; last harvest, July 21, 1919.
[5] Planted Sept. 20, 1919; first harvest, Nov. 6, 1919; last harvest, Dec. 1, 1919.

The highest average yield was obtained from plantings made in November, and the lowest yield from those made in September. Plat No. 4, which had received an application of potassium sulphate at the rate of 270 pounds per acre, made the highest yield of beans. Plat No. 5, to which 250 pounds of sodium nitrate and 625 pounds of acid phosphate had been applied, made the second highest yield. This was followed by plat No. 2, which had been treated with sodium nitrate, and plat No. 7, which received an application of sodium nitrate and potassium sulphate. The lowest yield was made by plat No. 1, which was left to serve as a check. Table 7 shows the effect of the fertilizers on the value of the average yield of the Lima beans of the five preceding tests.

TABLE 7.—*Value of increase in yield of Lima beans due to fertilizers*

Plat No.	Fertilizer treatment per acre	Average yield of beans per acre	Cost of fertilizers [1]	Value of beans [2]	Value of beans less cost of fertilizers	Increase or decrease due to fertilizers
		Pounds				
1	No fertilizer (check plat)	2,573.56	----------	$77.21	$77.21	----------
2	Sodium nitrate, 250 pounds	3,256.26	$10.00	97.69	87.69	$3.35
3	Acid phosphate, 625 pounds	3,167.50	12.50	95.03	82.53	−1.81
4	Potassium sulphate, 270 pounds	3,788.94	29.70	113.67	83.97	−.38
5	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds	3,458.76	22.50	103.76	81.26	−3.08
6	No fertilizer (check plat)	3,048.74	----------	91.46	91.46	----------
7	Sodium nitrate, 250 pounds; potassium sulphate, 270 pounds	3,215.00	39.70	96.45	56.75	−27.59
8	Acid phosphate, 625 pounds; potassium sulphate, 270 pounds	3,095.00	42.20	92.85	50.65	−33.69
9	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds; potassium sulphate, 270 pounds	3,091.24	52.20	92.74	40.54	−43.80
10	Sodium nitrate, 250 pounds; acid phosphate, 625 pounds; potassium sulphate, 270 pounds (one-half applied before and one-half applied after planting)	2,730.00	52.20	81.90	29.70	−54.64

[1] In Guam sodium nitrate costs 4 cents a pound, acid phosphate, 2 cents a pound, and potassium sulphate, 11 cents a pound. These figures are based on the average amount paid during the period 1914–1918, when most of the potassium sulphate was brought in.
[2] The value of the beans is based on the price paid for Lima beans at the local market, 3 cents a pound.

The column next to the last, which gives the value of the beans after deducting cost of fertilizers, shows that heavy applications of complete fertilizers were not profitable. A loss occurred in all plats with the exception of plat No. 2, which had received applications of sodium nitrate. Direct comparisons of the fertilized and unfertilized plats (see Table 5) show that the former yielded an average of 4,613.79 pounds, and the latter 3,368.71 pounds of beans per acre. The market value of these would have been $138.41 and $101.06, respectively. After $46.90 was deducted as the cost of fertilizers, the net value of the fertilized beans was $91.51, $9.55 less per acre than the value when fertilizers were not applied. It is concluded, therefore, that the value of Lima beans will not be increased by fertilizer applications or at least by the rate and manner in which these fertilizers were applied.

Pencil Pod Black Wax Bean (*Phaseolus* sp.)

Plantings of the Pencil Pod Black Wax beans have been most unsatisfactory in all tests made by the station since 1915. Of the 31 monthly tests made from 1915 to 1918, all were failures except those shown in Table 8.

Table 8.—*Effect of time of planting and fertilizers on yield of wax beans*

Date of planting	Date of first harvest	Date of last harvest	Yield per acre from fertilized plats	Yield per acre from unfertilized plats
			Pounds	*Pounds*
Sept. 24, 1915	Nov. 3, 1915	Dec. 14, 1915	1,300.00	925.00
Oct. 7, 1915	Nov. 30, 1915	Jan. 14, 1916	2,075.00	1,450.00
Oct. 27, 1915	Dec. 4, 1915	Feb. 7, 1916	1,550.00	1,150.00
June 5, 1917	July 21, 1917	Aug. 12, 1917	1,825.00	625.00
Oct. 15, 1917	Nov. 27, 1917	Jan. 2, 1918	4,262.50	1,675.00
Nov. 6, 1917	Dec. 24, 1917	Jan. 17, 1918	2,425.00	937.50
Nov. 19, 1917	Jan. 7, 1918	Jan. 28, 1918	1,275.00	475.00
Average yields			2,101.78	1,033.93

Table 8 shows that the fertilized plats yielded an average of 2,101.78 pounds and the unfertilized plats 1,033.93 pounds per acre. The yield in the fertilized plat was undoubtedly increased by the application of fertilizers, but it was not great enough to pay their cost. The station does not recommend the planting of these beans unless they are desired for home consumption.

Fijole (*Vigna sinensis*)

The fijole is a tropical variety of cowpea that produces large yields of edible green pods. In tests made at the station it has occupied the land for 88 days, the length of time from planting to first harvest averaging 55 days and the period of production covering 33 days.

In seven tests conducted on unfertilized land, the fijole made an average yield of 6,946.9 pounds of green beans per acre, and in five comparative tests it yielded an average of 9,890 pounds from fertilized plats, and 7,135 pounds from unfertilized plats. The highest yields on both the fertilized and unfertilized plats were obtained from plantings made in November. Table 9 shows the effects of time of planting and fertilizer on the yield of fijole:

TABLE 9.—*Effect of time of planting and fertilizers on yield of fijoles*

Test No.	Time of planting	Date of first harvest	Date of last harvest	Yield per acre from fertilized plat	Yield per acre from unfertilized plat
				Pounds	*Pounds*
1	Aug. 23, 1917	Oct. 19, 1917	Dec. 6, 1917	----------	9,725.0
2	Nov. 14, 1917	Jan. 7, 1918	Mar. 7, 1918	15,937.5	10,075.0
3	Nov. 14, 1917	Jan. 10, 1918	May 23, 1918	15,850.0	12,137.5
4	Dec. 24, 1917	Feb. 28, 1918	Apr. 4, 1918	3,925.0	3,225.0
5	Mar. 5, 1918	Apr. 27, 1918	May 23, 1918	3,237.5	4,900.0
6	Apr. 1, 1918	May 21, 1918	May 31, 1918	10,500.0	5,337.5
7	Jan. 10, 1919	Feb. 27, 1919	Mar. 3, 1919	----------	[1] 562.5
8	Jan. 10, 1919	----do----	----do----	----------	[1] 775.0
9	Sept. 16, 1919	Nov. 20, 1919	Dec. 29, 1919	----------	3,228.1
Average yield of each test	----------	----------	----------	9,890.0	6,946.9

[1] Not included in average. Allowed to produce seed instead of green beans.

SEGUIDILLA (*Psophocarpus tetragonoloba*)

The seguidilla, or "winged bean" variety, has produced a good quality of beans in all tests made at the station. Probably the greatest drawback to this plant is in the length of time that it requires to produce seed. In three tests the average time from planting to first harvest was 178 days. The results of these tests are given in Table 10.

TABLE 10.—*Effect of time of planting on yield of seguidillas*

Test No.	Date of planting	Date of first harvest	Date of last harvest	Yield per acre
				Pounds
1	May 14, 1919	Nov. 24, 1919	Dec. 29, 1919	4,737.5
2	June 1, 1919	Dec. 8, 1919	Dec. 15, 1919	3,006.3
3	July 10, 1919	Dec. 6, 1919	Jan. 21, 1920	4,437.5

BEETS (*Beta vulgaris*)

Beets grow fairly well at the end of the rainy season during the cool weather. In five tests made at the station, the first beets were ready for harvesting 45 days after planting and the last ones 53 days later. The yields on the regularly fertilized area were more than 60 per cent greater than those on the unfertilized plats. The yields were not high in any test, but the beets were of good quality except where they were attacked by insect pests.

Table 11 shows the results of the tests.

TABLE 11.—*Effect of time of planting and fertilizers on yield of beets*

Test No.	Time of planting	Date of first harvest	Date of last harvest	Acre yield from fertilized plat	Acre yield from unfertilized plat
				Pounds	*Pounds*
1	May 8, 1916	Aug. 17, 1916	Jan. 6, 1917	2,420	1,920.0
2	Dec. 7, 1916	Mar. 15, 1917	June 9, 1917	5,560	3,620.0
3	Mar. 12, 1917	May 8, 1917	June 13, 1917	2,760	980.0
4	May 12, 1917	July 8, 1917	Sept. 7, 1917	4,400	3,612.5
5	May 19, 1917	July 3, 1917	Aug. 25, 1917	1,900	225.0
Average	----------	----------	----------	3,408	2,071.5

Carrots (*Daucus carota*)

Carrots have been successfully grown for a number of years at the station. In 33 tests they were found to require an average of 98 days to produce roots large enough to harvest. All were not harvested until 64 days later. Six plantings a year will keep the family supplied with carrots.

Time of planting tests.—Plantings at the station were limited usually to the dry season extending from November to July, and only in very exceptional seasons was there failure to obtain fair results where irrigation water was available. Plantings made just before the rainy season often rotted before reaching maturity. Yields on unfertilized land varied from almost nothing to as high as 14,093.8 pounds per acre in very favorable years. The highest yields from unfertilized plats during six years, 1915 to 1920, were obtained from plantings made in November, October, September, and August, and the lowest from those made in April. The results of the six years' tests are shown in Table 12.

Table 12.—*Effect of time of planting on yield of carrots on unfertilized soil*

Month planted	Number of tests	Average yield per acre	Month planted	Number of tests	Average yield per acre
		Pounds			*Pounds*
January	3	2,014.6	August	2	3,325.0
February	-------	----------	September	3	5,131.3
March	3	1,993.8	October	6	7,498.9
April	1	50.0	November	6	7,592.3
May	2	1,887.5	December	1	2,100.0
June	1	175.0			
July	5	2,709.0	Average	-------	4,377.0

In tests carried on with and without fertilizers during three years to determine the effect of time of planting on yield, the highest yields from the fertilized plats were obtained from plantings made in October, November, August, and December, in the order named, and the lowest yields from those made in July, June, April, and January, respectively. The highest yields from unfertilized plats were obtained from plantings made in November, October, August, and December, in the order named, and the lowest from those made in April, June, July, and September. The results of the three years' tests are given in Table 13.

Table 13.—*Effect of time of planting on yield of carrots on fertilized and unfertilized soil*

Month planted	Number of tests	Yield per acre from fertilized plats	Yield per acre from unfertilized plats	Month planted	Number of tests	Yield per acre from fertilized plats	Yield per acre from unfertilized plats
		Pounds	*Pounds*			*Pounds*	*Pounds*
January	1	612.5	750.0	August	2	5,092.5	3,325.0
February	-------	----------	----------	September	1	900.0	287.5
March	1	1,025.0	650.0	October	4	9,708.3	5,668.8
April	1	600.0	50.0	November	3	7,670.8	6,257.5
May	2	2,868.5	1,887.5	December	1	2,900.0	2,100.0
June	1	187.5	175.0				
July	1	175.0	200.0	Average	-------	4,675.5	3,115.8

On the fertilized plats the yields averaged 4,675.5 pounds and on the unfertilized 3,115.8 pounds of carrots per acre. A comparison of Table 13 with Table 12 will show that the average of yields for the longer period was considerably the better of the two. This is probably accounted for by the fact that drainage had been provided in the garden where the longer test was made.

Tests of fertilizers.—Two tests, in the second of which the crop was partly damaged by heavy rains, were conducted to determine the effect of commercial fertilizers, singly and in combination, on the yield of carrots. The plats which received an application of acid phosphate and potassium sulphate gave the highest yields. The results do not seem to justify the use of commercial fertilizers, more especially since single applications of sodium nitrate, acid phosphate, and potassium sulphate, cost at the rate of $7, $8, and $16.50 per acre. The results of the tests are shown in Table 14:

TABLE 14.—*Effect of fertilizers on yield of carrots*

Plat No.	Fertilizer treatment per acre	Time applied	Yield per acre		Average
			Test No. 1	Test No. 2	
			Pounds	*Pounds*	*Pounds*
1	No fertilizer (check plat)		3,750.0	[1] 450.0	3,750.0
2	Potassium sulphate, 150 pounds	Before planting	3,787.5	(1)	3,787.5
3	Sodium nitrate, 175 pounds	do	3,250.0	[1] 525.0	3,250.0
4	do	One-half before and one-half after planting.	3,625.0	(1)	3,625.0
5	Acid phosphate, 400 pounds	Before planting	4,475.0	4,750.0	4,612.5
6	No fertilizer (check plat)		3,200.0	3,700.0	3,450.0
7	Potassium sulphate, 150 pounds; sodium nitrate, 175 pounds.	Before planting	1,987.5	2,775.0	2,381.3
8	Potassium sulphate, 150 pounds; acid phosphate, 400 pounds.	do	4,387.5	3,150.0	3,768.8
9	Potassium sulphate, 150 pounds; sodium nitrate, 175 pounds; acid phosphate, 400 pounds.	do	2,287.5	5,675.0	3,981.3
10	Potassium sulphate, 150 pounds; sodium nitrate, 175 pounds; acid phosphate, 400 pounds.	One-half before and one-half after planting.	906.3	6,500.0	3,703.2

[1] Plats Nos. 1, 2, 3, and 4 were almost destroyed by heavy rains and are not included in the average yields

CUCUMBERS (*Cucumis sativus*)

The cucumber is one of the most popular vegetables in Guam, and it is found growing in nearly all of the gardens.

Time of planting tests.—Cucumbers may be profitably planted at any time of the year, but they make heavy yields of fine quality when they are planted at the beginning of the rainy season. Cucumbers begin to bear in from 50 to 60 days after planting, and in 41 of the tests made at the station produced on an average of 57 days after planting. The time from the first harvest until the last averaged 32 days. Plants which fruited during the period of more intense heat often gave a large percentage of ill-shaped and immature cucumbers. Tests conducted during five years showed that the highest yields from fertilized plats were obtained from plantings made in May, August, June, and December, in the order named, and the lowest yields from those made in September, November, March, and January, respectively. The highest yields on unfertilized areas were had

from plantings made during December, April, May, and June, respectively, and the lowest from those made in August,[3] January, March, and November. The fertilized plats yielded more than twice as much as the unfertilized. Table 15 gives the effect of time of planting and fertilizers on yield of cucumbers.

TABLE 15.—*Effect of time of planting on yield of cucumbers on fertilized and unfertilized soil*

Month planted	Fertilized area		Unfertilized area	
	Number of tests	Yield per acre	Number of tests	Yield per acre
		Dozen		*Dozen*
January	3	605.53	4	154.15
February	2	787.50	3	488.86
March	1	500.00	3	250.90
April	3	1,260.83	4	814.45
May	2	2,816.50	3	802.63
June	4	1,855.12	3	721.53
July	3	1,111.10	7	622.59
August	3	2,558.33	1	----------
September	4	322.95	8	423.11
October	6	1,070.83	8	557.63
November	2	450.00	3	400.36
December	2	1,500.00	2	1,000.00
Average	-------	1,238.64	-------	532.06

In Table 15 the fertilized plats yielded an average of 706.58 dozen more cucumbers per acre than did the unfertilized ones. On account of their superior quality, the cucumbers produced on fertilized soil were given a market value of $115.19, and the cucumbers from unfertilized soil were valued at $36.71, which is a difference of $78.48 in favor of the former. However, inasmuch as the market value of the three commercial fertilizers was $78.20, the net proceeds would show considerable loss were the cost of the fertilizers and the value of the manure to be taken into consideration.

Tests of fertilizers.—The fertilizers used in tests with cucumbers varied somewhat from those used on the vegetables other than vine-crop varieties. Preparatory to planting cucumbers it was decided to dig holes 6 inches square and 5 inches deep, at the required distance apart, and line them with about one-fifth of a shovelful of rotted manure. Approximately one-fourth pound of sodium nitrate, one-fourth pound of acid phosphate, and one-eighth pound of potassium sulphate were then placed in each hole and well mixed with the soil. This resulted in an application of over one-half ton of manure, about 660 pounds each of sodium nitrate and acid phosphate, and 330 pounds of potassium sulphate per acre, which is of course too heavy for the difference in return that might be obtained from the increase due to the use of fertilizer. Table 16 shows the effect of fertilizers and of Bordeaux spray in addition to fertilizers.

[3] August should not be included among the unfavorable months for planting cucumbers because only one planting was made on unfertilized soil during this month, and the data are therefore not sufficient for drawing conclusions.

TABLE 16.—*Effect of fertilizers and Bordeaux spray on yield of cucumbers*

Plat No.	Fertilizer treatment per acre	Yield per acre— Test No. 1 [1]	Test No. 2 [2]	Test No. 3 [3]	Test No. 4 [4]	Average
		Dozen	*Dozen*	*Dozen*	*Dozen*	*Dozen*
1	Manure, 3,000 pounds; sodium nitrate, 928 pounds; acid phosphate, 1,856 pounds; potassium sulphate, 464 pounds	1,081.4	927.6	21,022.0	4,735.5	6,941.60
2	Manure, 3,000 pounds; acid phosphate, 1,856 pounds; potassium sulphate, 464 pounds	1,454.5	4,557.6	6,898.0	6,329.5	4,809.90
3	Manure, 3,000 pounds	2,422.5	6,639.8	9,250.0	6,370.5	6,170.70
4	No fertilizer (check plat)	1,008.3	1,794.8	2,690.0	3,649.0	2,285.53
5	Manure, 3,000 pounds; sodium nitrate, 928 pounds; potassium sulphate, 464 pounds	1,895.6	670.4	6,934.0	4,459.5	3,489.88
6	Manure, 3,000 pounds; sodium nitrate, 928 pounds; acid phosphate, 1,856 pounds	3,909.7	1,149.4	6,754.0	5,494.0	4,326.78
7	Manure, 3,000 pounds; sodium nitrate, 464 pounds; acid phosphate, 928 pounds; potassium sulphate, 232 pounds	1,608.2	408.3	8,446.0	5,432.5	3,973.75
8	Manure, 3,000 pounds; sodium nitrate, 464 pounds; acid phosphate, 928 pounds; potassium sulphate, 232 pounds (plants sprayed once weekly with Bordeaux mixture)	98.2	473.8	4,310.0	2,219.0	1,775.25
9	Manure, 3,000 pounds; sodium nitrate, 464 pounds; acid phosphate, 928 pounds; potassium sulphate, 232 pounds (plants sprayed twice weekly with Bordeaux mixture)	178.9	201.6	2,583.0	1,078.0	1,010.38
10	Manure, 3,000 pounds; sodium nitrate, 464 pounds; acid phosphate, 928 pounds; potassium sulphate, 232 pounds (plants sprayed three times weekly with Bordeaux mixture)	398.2	428.5	4,223.0	558.2	1,401.98
	Average	1,405.55	1,725.18	7,311.00	4,032.57	----------

[1] Planted Aug. 21, 1916.
[2] Planted Feb. 10, 1917.
[3] Planted July 12, 1917.
[4] Planted Dec. 1, 1917.

Plat No. 6 in the first test and plat No. 1 in the third test were better drained than the other plats in each of these tests, a fact which probably accounts for their abnormally large yields. As has been the case in nearly all experiments made at the station, barnyard manure gave high returns, being second in average yield. Yields were not so heavy on the plats sprayed with Bordeaux mixture as they were on the unsprayed plats.

Cucumbers were planted on three plats in August, 1916, it being the purpose of the station to conduct a disease-control experiment during the rainy season. Plat No. 1 was frequently sprayed with Bordeaux mixture after the plants were 3 weeks old. Plat No. 2 was provided with a bamboo trellis for keeping the vines off the ground, and plat No. 3 was left to serve as a check, the vines being allowed to trail. Each plat was one-fiftieth acre in size and was fertilized in the regular manner. The first harvest from all the plats was made on October 13, 46 days after planting, and the last harvest from plats Nos. 1 and 3 on November 3, and from plat No. 2, five days earlier. The sprayed plat yielded at the rate of 27,650 cucumbers weighing 10,035 pounds; the trellised plats, 27,200 cucumbers weighing 10,940 pounds; and the check plat, 39,300 cucumbers weighing 14,000 pounds per acre. Less mildew was apparent on the sprayed plants than on the unsprayed, but the fruit did not set so well on the former as on the latter. The bamboo trellis did not seem to be beneficial.

Eggplant (*Solanum melongena*)

Both the native eggplant and the introduced New York Improved variety are commonly found growing in the gardens of Guam. In 25 tests made by the station, it was found that the New York Improved variety matured in an average of 88 days and continued to produce for 82 days, whereas the native eggplant matured in 59 days and continued to produce for 51 days. In all tests the first fruits of all the introduced varieties of eggplants were invariably larger than those produced later, the plants at first bearing fruits weighing more than 2 pounds and later fruits which weighed little more than half a pound in some instances.

Time of planting tests.—Very satisfactory yields of eggplants were obtained in nearly all of the tests conducted by the station. Yields varied from less than 1 to almost 15 tons per acre on unfertilized lands. Eggplants can be successfully planted in the field at any time of the year except during the extremely dry periods. Only a few instances of failures have been known to occur, but the yields have varied greatly with the different times of planting. An average of 24,148 fruits weighing 14,880.6 pounds was obtained per acre from 28 unfertilized plats, and an average of 21,614 eggplants weighing 18,927 pounds per acre was obtained from 14 regularly fertilized plats. Table 17 shows the effect of time of planting and fertilizer on yield in tests made between 1915 and 1920.

Table 17.—*Effect of time of planting on yield of eggplant on fertilized and unfertilized soil*

Month planted	Yield per acre					
	Fertilized			Unfertilized		
	Number of tests	Number of eggplants	Weight	Number of tests	Number of eggplants	Weight
			Pounds			*Pounds*
January	3	26,833	23,625.0	7	22,886	16,639.5
February				1	6,200	5,975.0
March	2	5,200	7,462.5	1	1,600	1,475.0
April						
May				2	26,900	7,456.3
June				1	18,600	3,987.5
July	1			1		
August				1	48,552	21,738.8
September	2	30,700	25,468.8	6	18,150	11,029.5
October	2	7,400	7,331.3	2	6,900	5,762.5
November	3	42,833	34,360.0	6	44,083	29,106.9
December	1	7,000	10,500.0			
Average		21,614	18,927.2		24,148	14,880.6

In these tests the number of plantings made on the fertilized area was not great enough to allow a comparison for all months. The general results are similar to those obtained from the unfertilized land which was planted more regularly than was the fertilized. No plantings were made on the unfertilized areas during April and December, and heavy continuous rains and lack of proper drainage caused the only planting made during July to be a failure. The highest yields were obtained from plantings made in November,

August, January, and September. The fruits produced during the dry season were uniformly of excellent flavor and texture. Few fruits set during the rainy season and these had a tendency to rot before they were one-third grown.

Tests of fertilizers.—In five tests that were directly comparable it was found that the average number of eggplants per acre on fertilized land was 25,080, weighing 21,501 pounds, whereas on unfertilized land the average was 17,860 fruits which weighed 15,003.5 pounds. The result was an average increase of 7,220 eggplants weighing 6,497.5 pounds per acre of the fertilized over the unfertilized land.

In an experiment to determine the effect of shade on the yield of eggplants on both fertilized and unfertilized plats, single layers of coconut leaves were placed on light bamboo frames which were raised 3 or 4 feet over the plants. This afforded partial shade only. Table 18 gives the results of the tests which were extended through the dry season.

TABLE 18.—*Effect of shade on yield of eggplant on fertilized and unfertilized soil*

Test No.	Date planted	Treatment	Fertilized area		Unfertilized area	
			Number of eggplants per acre	Weight per acre	Number of eggplants per acre	Weight per acre
				Pounds		*Pounds*
1	Sept. 11	Not shaded	55,000	41,337.5	21,400	16,762.5
2	Oct. 17	Shaded	4,200	5,700.0	6,800	4,275.0
		Not shaded	10,600	8,962.5	7,000	7,250.0
3	Nov. 24	Shaded	76,800	50,625.0	----------	----------
		Not shaded	----------	----------	95,600	60,025.0
4	Jan. 2	Shaded	59,600	50,325.0	----------	----------
		Not shaded	----------	----------	27,600	20,200.0

Test No. 1 gives the yields of unshaded eggplants on both fertilized and unfertilized plats. The fertilized plat yielded nearly 2.5 times as much as the unfertilized plat. Test No. 2 shows that shading greatly reduced the yield and weight of eggplants on both fertilized and unfertilized plats. The average of tests Nos. 3 and 4 shows that the largest yield in number and weight of eggplants was from the shaded and fertilized plat, but that the increase was not large enough to more than pay the cost of the fertilizers and shade. It is considered that shading decreases the yield of eggplant unless fertilizers are applied.

LETTUCE (*Lactuca sativa*)

In so far as production is concerned, lettuce has given very satisfactory results in all tests made at the station, yields having varied from a little less than 3,000 pounds to nearly 7,000 pounds per acre on unfertilized land. The average yield in 32 tests which were made during five years was 4,819.8 pounds per acre.

Time of planting tests.—Where proper drainage was given, the highest yields were obtained from plantings made during the season of plenty of moisture and cool temperature, from November to March. This period is usually followed by a season of hot, dry

weather and constant sunshine when varieties of the Cos strain are most successful. The highest yields were obtained from plantings that were made during November, August, October, and January. No plantings were made in April or June. The lowest recorded yield was obtained from a planting made in May. Table 19 shows the effect of time of planting on yield of lettuce.

TABLE 19.—*Effect of time of planting on yield of lettuce*

Month	Number of tests	Yield per acre	Month	Number of tests	Yield per acre
		Pounds			*Pounds*
January	7	5,453.6	July	3	5,416.6
February	2	4,075.0	August	1	5,825.0
March	7	3,583.9	September	4	3,048.4
April			October	1	5,575.0
May	1	2,962.5	November	5	6,946.2
June			December	1	5,287.5

Tests of fertilizers.—Lettuce readily responded to applications of fertilizers, producing a better quality of leaf than that grown on unfertilized land. The leaves were large, tender, and crisp, and lacked the bitter taste frequently found in the slow-growing plants. Only four tests were made for the purpose of directly comparing the effects of fertilized and unfertilized plantings. The former made an average yield of 8,850 pounds and the latter, 5,419 pounds of lettuce per acre. The fertilized plats received the applications commonly used in the garden work. The results obtained seemed to indicate that the applications of potassium sulphate had been too heavy and that larger quantities of acid phosphate than were applied could have been profitably used. Lettuce yields were also materially increased on plats which had been given applications of barnyard manure or on which crops had been turned under for green manure.

MUSKMELON (*Cucumis melo*)

Few muskmelons can be matured in Guam. The vines set a large number of fruits, most of which drop when they are about the size of a baseball. The fruit ripens 10 or 11 weeks after the seed has been planted. The average period of production of introduced varieties at the station was 21 days.

Time of planting tests.—Results obtained from planting at different seasons showed that the highest yields were had from plantings made after the rainy season was well past. Plantings made from January to March were generally more satisfactory than those made at any other time.

Tests of fertilizers.—Of 10 plats that were regularly fertilized during three years, only five produced any melons. These averaged per acre 1,866 melons, weighing 2,100 pounds. Of 15 tests made on unfertilized land, 4 were failures and 11 produced an average per acre of 1,664 melons, weighing 2,202.1 pounds. An average of 6,550 melons, weighing 7,606.3 pounds, was obtained from two plantings of native melons made in January; 2,600 melons, weighing 5,468.8 pounds, were obtained in a test made in March; and 900 melons, weighing 2,437.5 pounds, were obtained from a test made in

April. The fertilized imported melons averaged 1.08 pounds each; the unfertilized imported melons, 1.3 pounds each; and the unfertilized native melons, 1.54 pounds each.

Mustard (*Brassica juncea*)

The highest yields of mustard were obtained from plantings that were made in April, May, June, and September, respectively, and the largest number of failures were had from plantings made during November, December, January, and July, respectively. These results seem to indicate that the most favorable time for planting mustard is either at the beginning or at the end of the rainy season.

In 11 unfertilized tests made at the station, the crop made a yield of 12,422.3 pounds per acre. Plats which were fertilized gave a slightly larger yield and a much better quality of leaf than did the unfertilized areas.

Okra (*Hibiscus esculentus*)

Okra makes vigorous growth throughout the dry season, is correspondingly productive and is easy of cultivation in Guam. The plant produces several crops when it is given proper care.

Time of planting tests.—Owing to the length of time required to complete a test with okra, the station made comparatively few tests with this vegetable. Plantings that were made in September and July gave the highest yields, and the crops were well established before they were affected by dry weather. Table 20 shows the effect of time of planting on yield of okra:

TABLE 20.—*Effect of time of planting on yield of okra on fertilized and unfertilized soil*

Month planted	Fertilized area		Unfertilized area		Month planted	Fertilized area		Unfertilized area	
	Number of tests	Yield per acre	Number of tests	Yield per acre		Number of tests	Yield per acre	Number of tests	Yield per acre
		Pounds		*Pounds*			*Pounds*		*Pounds*
January	1	14,375.0	[1] 2	24,137.5	July	1	54,375.0	2	42,556.8
February	1	33,425.0	1	18,075.0	August				
March					September	1	63,950.0	1	43,550.0
April	1	22,450.0			October	1	16,400.0	1	11,225.0
May					November	2	39,393.8	2	24,175.0
June	1	22,450.0	1	26,800.0	December				

[1] Typhoon destroyed planting in one test.

Tests of fertilizers.—Yields in nearly all tests were large and the quality was good. In 10 unfertilized tests made at different times of the year, the average yield was 27,217 pounds of okra pods per acre, and in 9 fertilized tests the average yield in each test was 33,352.35 pounds per acre. In 6 unfertilized tests, all of which produced one crop, and 2 two crops after being pruned back, the total average yield was 29,574 pounds. The first crop before being pruned back yielded 15,034 pounds; the second crop, 13,343 pounds; and the third crop, 3,600 pounds. Table 21 gives the results of the six tests on unfertilized land.

TABLE 21.—*Comparative yields of first, second, and third crops of unfertilized okra*

Date planted	First crop		Second crop		Third crop		Total yield per acre
	Date harvested	Yield per acre	Date harvested	Yield per acre	Date harvested	Yield per acre	
		Pounds		*Pounds*		*Pounds*	*Pounds*
July 2	Sept. 14 to Nov. 2	7,725	Nov. 27 to Apr. 15	20,625	May 3 to Aug. 2	6,100	34,450
Sept. 3	Nov. 16 to May 11	28,850	May 27 to Aug. 7	13,600	Aug. 8 to Aug. 13	1,100	43,550
Oct. 7	Dec. 4 to Apr. 14	9,225	May 11 to Aug. 4	2,000			11,225
Nov. 17	Jan. 18 to Aug. 4	18,200	Aug. 6 to Nov. 3	9,650			27,850
Jan. 14	Mar. 17 to Aug. 4	7,675	Aug. 8 to Sept. 26	1,700			9,375
July 14	Sept. 27 to Dec. 17	18,511	Dec. 19 to May 31	32,485			50,996
Average		15,034		13,343		3,600	29,574

ONIONS (*Allium cepa*)

Onions are grown from seed with great difficulty in Guam. Imported sets have produced fairly good crops, but the yields have been low in most instances, ranging from 1,844 to 15,800 pounds per acre. The native variety has yielded as high as 8,868.8 pounds per acre. In a test made to determine the effect of fertilizers on yield when onions were planted as sets nearly a foot apart, the regularly fertilized plats yielded 9,300 onions weighing 2,675 pounds, and the unfertilized plats 8,800 onions weighing 1,844 pounds per acre.

PEPINO (*Cucurbita* sp.)

The pepino varies greatly both in vine and in fruit characteristics, but the better sorts are prolific bearers of fruit of good quality and flavor. Plantings made in March, April, June, and July gave the largest yields, although a late planting made in July failed. In 10 tests, one of which was a failure, the average yield was 11,123 pepinoes weighing 9,218.75 pounds per acre. Table 22 shows the effect of time of planting on yield of pepinoes.

TABLE 22.—*Effect of time of planting on yield of pepinoes*

Test No.	Date of planting	Date of first harvest	Date of last harvest	Number of pepinoes per acre	Weight of pepinoes per acre
					Pounds
1	Apr. 28, 1919	July 10, 1919	Aug. 14, 1919	10,000	12,031.25
2	June 17, 1919	Sept. 22, 1919	Oct. 8, 1919	8,667	9,883.33
3	July 11, 1919	Oct. 3, 1919	Nov. 3, 1919	10,400	9,316.67
4	July 25, 1919	(1)			
5	Aug. 28, 1919	Nov. 3, 1919	Nov. 20, 1919	9,000	6,000.00
6	Sept. 28, 1919	Dec. 22, 1919	Dec. 30, 1919	15,333	7,854.17
7	Nov. 8, 1919	Feb. 7, 1920	Feb. 16, 1920	3,900	2,481.25
8	Nov. 28, 1919	Feb. 10, 1920	Feb. 24, 1920	4,600	3,350.00
9	Mar. 6, 1920	May 8, 1920	July 5, 1920	29,133	23,258.33
10	Apr. 4, 1920	June 14, 1920	July 22, 1920	20,200	18,012.50
Average				11,123	9,218.75

[1] Failure.

PEPPERS (*Capsicum* sp.)

Peppers are produced in Guam the year round. All varieties, from the small native chili pepper to the large bell type, do exceptionally well. In 72 tests made with imported varieties of peppers, the variety Large Bell or Bull Nose made the highest yield, producing

10,296.04 pounds of green peppers per acre. In 49 tests, this variety averaged 76 days from time of transplanting to first harvest, after which the plants continued to bear on an average of 144 days. The size and quality of peppers varied with the season and the age of the plants, but in nearly all the tests the earlier peppers were the largest, sweetest, and crispest. In a large number of the tests from the first three harvests of each test it required an average of 10 peppers to make a pound. From the last three tests, an average of 28 peppers was required to make a pound, and in the complete tests the average was 14 peppers to the pound.

Time of planting tests.—The highest yields were obtained from plantings made in February, six of which yielded at the rate of 20,404.17 pounds of peppers per acre. The next largest yields were from plantings made in October, January, and August, respectively. A planting made in June and another in April were complete failures, due in the first instance to heavy rains, and in the second to drought. Plantings made in July, December, and March gave the lowest yields. Peppers produced in the rainy season, however, were decidedly mild and sweet; whereas those produced in the dry season, especially when the growth of the plant was retarded, were of a hot and pungent flavor. These results were invariably had from the same plantings if the fruiting period extended through both the wet and the dry season. Table 23 shows the effect of time of planting on yield of peppers:

TABLE 23.—*Effect of month of planting on yield of peppers*

Month planted	Number of tests	Number of pods per acre	Weight of pods per acre	Month planted	Number of tests	Number of pods per acre	Weight of pods per acre
			Pounds				*Pounds*
January	5	267,440	14,760.00	August	5	145,880	8,625.00
February	6	302,533	20,404.17	September	11	103,025	6,248.17
March	9	43,244	3,904.18	October	3	179,200	15,958.33
April	-------	-------	-------	November	11	122,667	8,203.63
May	2	109,800	7,162.50	December	2	60,500	3,618.75
June	1	-------	-------				
July	1	18,600	1,275.00	Average	-------	136,610	9,015.97

Tests of fertilizers.—Fertilizers have been found to be beneficial to peppers, not only increasing the size and yield of the fruit, but also improving its quality. During the period 1915–1920, the average yield from 31 regularly fertilized plats was 149,674 peppers weighing 11,912.45 pounds per acre. In 54 tests on unfertilized plats, the average yield was 141,670 peppers weighing 9,417.96 pounds per acre. The highest yield of the Large Bell variety on unfertilized land was 390,800 peppers weighing 24,425 pounds per acre, and the lowest was 1,600 peppers weighing 150 pounds.

The station made 21 tests on fertilized and unfertilized plats which were planted from 1916 to 1918. The four highest average yields on fertilized plats were obtained from plantings that were made in September, October, November, and August, respectively, and on the unfertilized plats from those made in September, October, January, and August, in the order named. No plantings were recorded for February, April, June, and July. Applications of fertilizer very materially increased the yield of plantings made in November and December. Unfertilized plats that were planted during January yielded an average of 1,825 pounds more per acre

during the three tests than did the fertilized plats. The regular fertilized plats showed a total increase of 60,042 peppers weighing 5,696.55 pounds over the yield of the unfertilized plats. Table 24 gives the results of the test.

TABLE 24.—*Effect of time of planting on yield of peppers on fertilized and unfertilized soil*

Month planted	Number of tests	Fertilized area		Unfertilized area	
		Number of pods per acre	Weight of pods per acre	Number of pods per acre	Weight of pods per acre
			Pounds		*Pounds*
January	3	160,533	10,958.33	206,400	12,783.33
March	5	21,500	2,575.50	13,360	1,382.50
May	1	223,400	15,662.50	125,400	8,412.50
August	4	267,050	18,125.00	182,350	10,781.25
September	1	335,200	28,700.00	247,100	18,350.00
October	3	263,800	21,154.17	179,200	15,958.33
November	3	228,500	19,235.00	66,000	3,788.33
December	1	147,000	11,000.00	55,400	3,775.00
Average	-------	182,847	14,037.26	122,805	8,484.04

Since the regular fertilizers cost about $46.90 per application, and the peppers had a marketable value of $170.90, a gain of $124 per acre was made as the result of using fertilizers. The cost of applying the fertilizers and of the labor employed in harvesting and marketing the increased yield was amply compensated for by the extra fine quality of peppers that were obtained from the whole test.

A special fertilizer experiment was started to determine the best combination of fertilizers to use on peppers. A sufficient number of tests have not been made to warrant the drawing of definite conclusions, but it is thought that the results obtained show in some measure the value of fertilizers when used in certain combinations. The first test was started on August 10 with plants that were transplanted from flats; the first harvest was made on November 3; and the last on June 6, 1917, or 300 days after transplanting. The second test was started on August 15 of the following year, the first harvest was made on November 12 from the first plats; and on January 17 from plat No. 5; and the last on June 24 and May 27, or 313 and 285 days, respectively, after the peppers were transplanted. The results of the experiment are given in Table 25.

TABLE 25.—*Result of tests of different combinations of fertilizers on peppers*

Plat No.	Fertilizer treatment per acre	First test		Second test		Average	
		Number of pods per acre	Weight of pods per acre	Number of pods per acre	Weight of pods per acre	Number of pods per acre	Weight of pods per acre
			Pounds		*Pounds*		*Pounds*
1	Sodium nitrate, 200 pounds; acid phosphate, 350 pounds; potassium sulphate, 100 pounds	236,000	11,387.5	241,600	16,325.0	238,800	13,856.3
2	Sodium nitrate, 200 pounds; potassium sulphate, 100 pounds	213,400	10,587.5	269,200	15,250.0	241,300	12,918.8
3	Sodium nitrate, 200 pounds; acid phosphate, 350 pounds	314,000	15,425.0	364,000	20,550.0	339,000	17,987.5
4	Acid phosphate, 350 pounds; potassium sulphate, 100 pounds	352,400	15,787.5	259,600	14,225.0	306,000	15,006.3
5	No fertilizer (check plat)	221,600	9,750.0	[1] 31,600	[1] 1,850.0	126,600	5,800.0

[1] This test was probably affected by proximity of a large mango tree.

In these tests, as in nearly all other fertilizer tests made in Guam, the combination of sodium nitrate and acid phosphate gave the best results. These fertilizers were applied in plat No. 3 at the rate of 200 and 350 pounds, respectively, per acre. The second highest yield was obtained from plat No. 4, which had received an application of 350 pounds of acid phosphate and 100 pounds of potassium sulphate. The cost of the combination used on plat No. 3 was about $15 per acre; that used on plat No. 4 was $18 per acre; and that on plat No. 1, $26 per acre. The average yield on plat No. 5, which was a check, is hardly a fair one for comparative purposes, because plantings in the second test were made near a large mango tree and growth was considerably affected by it.

The hot dry season has a decided effect upon the growth of the sweet or imported varieties. This can be overcome to a large extent by shading with coconut leaves placed on frames. Four tests were made during two years to determine the effect of shade upon yield of peppers in both unfertilized and fertilized plats. The first plantings in each test were made on fertilized plats in January of each year and the second plantings were made on both fertilized and unfertilized plats in March of each year. The January plantings made the highest yields. The shaded plats yielded nearly twice as many peppers as the unshaded plats and the fruit weighed three times as much as that obtained from the unshaded plats. In the second test of each year, both fertilized and unfertilized plats made larger yields than they did in the first test. The shaded plats (fertilized and unfertilized) in the second test made an average yield of 15,400 peppers weighing 2,337.5 pounds, whereas the unshaded plats yielded an average of 5,675 peppers, weighing 512.5 pounds per acre. The first and second tests were made in the dry season, but of the two the second test was much more affected by the dry weather. Table 26 gives the results of shading on yield on fertilized and unfertilized plats.

TABLE 26.—*Effect of shading and fertilizers on yield of peppers*

Test No.	Treatment	First year			Second year			Average		
		Number of peppers per acre	Weight of peppers per acre	Average number of peppers per pound	Number of peppers per acre	Weight of peppers per acre	Average number of peppers per pound	Number of peppers per acre	Weight of peppers per acre	Average number of peppers per pound
			Pounds			*Pounds*			*Pounds*	
1	Fertilized, shaded	67,000	8,550	7.8	131,600	13,100	10.0	99,300	10,825	9.1
	Fertilized, unshaded	37,600	3,000	12.5	70,200	3,800	18.5	53,900	3,400	15.9
2	Fertilized, shaded	18,800	2,350	8.0	22,400	5,000	4.5	20,600	3,675	5.6
	Fertilized, unshaded	3,300	350	9.4	10,000	950	10.5	6,650	650	10.2
	Unfertilized, shaded[1]	5,600	700	8.0	14,800	1,300	11.4	10,200	1,000	10.2
	Unfertilized, unshaded	1,600	150	10.6	7,800	600	13.0	4,700	375	12.5

[1] After July 26 the shaded plats gave no yield, while the unshaded plats yielded as follows: Fertilized and unshaded, 53,400 peppers, weighing 4,550 pounds; unfertilized and unshaded, 28,200 peppers, weighing 2,150 pounds.

These tests showed that shading increased the size and yield of peppers and decreased the pungency and otherwise improved the quality. Shading not only increased yield but it also shortened the harvest period of the whole crop to a very noticeable extent. The combination of fertilizer with shade gave yields from nearly two to

six times as great as those obtained from the unshaded, unfertilized plats.

Radish (*Raphanus sativus*)

Very satisfactory yields of radish have been obtained in nearly all tests made at the station. The Chinese White Winter variety has given the largest yields, followed by the varieties Cincinnati Market and Early Scarlet Globe, the yields being in proportion to the relative size of each variety. Table 27 shows the yield of the three varieties on fertilized and unfertilized plats.

Table 27.—*Comparison in yield of varieties of radish on fertilized and unfertilized plats*

Variety	Fertilized area		Unfertilized area	
	Number of tests	Weight of radishes	Number of tests	Weight of radishes
		Pounds		*Pounds*
Chinese White Winter	2	20,406.25	10	7,616.26
Cincinnati Market	29	5,265.43	35	2,705.63
Early Scarlet Globe	2	3,975.00	4	1,196.40

Time of planting tests.—May is one of the best months to plant radishes for large yields. Plantings made in May both on fertilized and unfertilized plats have given the largest yields. In 62 tests covering a period of five years at the station, the highest yields on unfertilized plats were obtained from plantings made in May, September, March, and August, respectively, and the lowest yields from those made in January, February, June, and November, in the order named. Failures were reported from two plantings made in January and September; three in December; and one each from plantings made in February, March, April, July, October, and November. Some of the failures were caused by soil or climatic conditions and others were caused by webworms.

In 49 tests covering three years' work at the station on regularly fertilized plats, plantings made during May, December, September, and August gave the highest average yields. The lowest average yields were obtained from plantings made in January, February, March, and April. Failures were recorded for two plantings made in December, and one during each of January, February, March, and April. Table 28 shows the effect of time of planting on yield of radish.

Table 28.—*Effect of time of planting on yield of radishes, fertilized and unfertilized*

Month planted	Fertilized area		Unfertilized area		Month planted	Fertilized area		Unfertilized area	
	Number of tests	Weight of radishes	Number of tests	Weight of radishes		Number of tests	Weight of radishes	Number of tests	Weight of radishes
		Pounds		*Pounds*			*Pounds*		*Pounds*
January	1	0	2	0	August	3	5,512.50	3	2,696.67
February	1	0	1	0	September	3	5,850.00	7	3,434.97
March	4	2,756.25	5	3,027.50	October	6	5,307.92	13	2,662.69
April	2	3,550.00	5	1,897.50	November	4	3,771.87	4	1,275.00
May	5	9,932.50	9	5,878.47	December	4	6,025.00	5	2,390.00
June	2	5,250.00	3	1,125.00					
July	4	4,512.50	5	2,147.50	Average		5,165.64		2,829.73

Tests of fertilizers.—The radish responds very readily to all kinds of fertilizer. Not only are the yields increased where fertilizer is used, but the quality of radish is greatly improved. In an experiment having for its object the determination of the effect of time of application of sodium nitrate in combination with certain other fertilizers, 10 tests have been completed. All the plats with the exception of No. 1, which was left to serve as a check, were treated with 320 pounds of acid phosphate and 160 pounds of potassium sulphate per acre. In addition, 200 pounds of sodium nitrate were applied to plat No. 2 before planting; to plat No. 3 one-half at planting time and one-half two weeks later; to plat No. 4, one-third at planting time, one-third one week later, and one-third two weeks after planting; and to plat No. 5, one-fourth at planting time, one-fourth one week after, one-fourth two weeks and one-fourth three weeks after planting. Through oversight, acid phosphate and potassium sulphate were not applied to the check plat in the first five tests. These were added during the second year. As the two years' results are so variable, the average data are given separately under first and second years in Table 29.

TABLE 29.—*Effect of time of application of sodium nitrate on yield and quality of radishes*

Plat No.	Yields per acre, first year					Yields per acre, second year					Average		Quality
	Test No. 1	Test No. 2	Test No. 3	Test No. 4	Test No. 5	Test No. 6	Test No. 7	Test No. 8	Test No. 9	Test No. 10	First year	Second year	
	Lbs. (1)	*Lbs.* (2)	*Lbs.* (3)	*Lbs.* (4)	*Lbs.* (5)	*Lbs.* (6)	*Lbs.* (7)	*Lbs.* (8)	*Lbs.* (9)	*Lbs.* (10)	*Lbs.*	*Lbs.*	
1	1,843	1,450	787	750	650	1,600	2,900	5,100	1,800	4,100	1,096.0	3,100.0	Poor to fair.
2	2,775	2,550	4,281	2,200	1,750	7,025	7,850	9,600	4,800	2,900	2,711.2	6,435.0	Very good to excellent.
3	2,131	2,218	3,443	2,518	900	5,525	3,700	9,075	3,725	6,775	2,242.0	5,760.0	Good.
4	2,762	2,456	3,706	2,047	1,187	5,550	3,675	8,025	5,775	5,275	2,431.0	5,660.0	Good to very good.
5	1,806	2,712	2,637	2,875	1,187	4,025	3,325	8,925	3,025	4,150	2,243.4	4,690.0	Good.
6	------	------	------	------	------	3,700	5,800	9,225	4,050	3,950	-------	5,345.0	Fair.

[1] Planted Aug. 4, 1916.
[2] Planted Sept. 9, 1916.
[3] Planted Oct. 10, 1916.
[4] Planted Nov. 27, 1916.
[5] Planted Mar. 26, 1917.
[6] Planted Aug. 23, 1917.
[7] Planted Nov. 6, 1917.
[8] Planted Dec. 20, 1917.
[9] Planted Feb. 20, 1918.
[10] Planted Apr. 12, 1918.

The advantage of using fertilizers can be seen by comparing the average results obtained from check plat No. 1 with the results obtained from the other plats. Plat No. 2, which was treated with the full amount of sodium nitrate before planting, made the highest yield, producing 1,615.2 pounds more per acre than plat No. 1 in the average for the first year, and 3,335 pounds more in the second year, and 1,090 pounds more than plat No. 6 with which it is directly comparable. This yield was gradually decreased when applications of sodium nitrate were extended over the regular period of time. The effect of applying acid phosphate and potassium sulphate can be seen by comparing plat No. 1 with plat No. 6. The latter shows an average increase of 2,245 pounds of radishes per acre over the check plat. These data show that both for production and quality of radishes, a full amount of sodium nitrate should be applied just before planting.

Squash (*Cucurbita* sp.)

The production of squashes has been very uniform in all tests where the vines were not damaged by strong winds or attacked by fungus.

Time of planting tests.—The highest yields on fertilized plats were obtained from plantings made in March, January, and October, and the average weight of squashes was 2.4, 1.3, and 1.0 pounds, respectively. The highest yields on unfertilized plats were obtained from plantings made in March, February, and January, in the order named, when the average weight of the squashes was 2.3, 1.5, and 0.9 pounds, respectively. The lowest number of fruits on unfertilized plats was obtained from plantings made in August, June, and September, and the lowest weights from plantings made in December, September, and July. Few plants in any tests set fruit during rainy weather.

Tests of fertilizers.—Twenty-three regularly fertilized plats that were planted during three years gave an average yield of 7,509 squashes, weighing 13,779.8 pounds, per acre. Forty-two unfertilized plats that were planted during a period of five years produced an average of 6,277 squashes, weighing 8,962.1 pounds, per acre. The fertilizer increased the yield 4,817.7 pounds per acre. It is thought that the same or even a larger and more profitable yield would have been produced had manure and a cheaper combination of fertilizer been used. The effect of time of planting and fertilizer on yield of squash is shown in Table 30.

Table 30.—*Effect of time of planting on yield of fertilized and unfertilized Bush squash*

Month planted	Fertilized area			Unfertilized area		
	Number of tests	Number of squash per acre	Weight of squash per acre	Number of tests	Number of squash per acre	Weight of squash per acre
			Pounds			*Pounds*
January	5	12,700	17,112.5	6	12,983	11,410.4
February				2	8,700	13,284.4
March	4	9,000	22,145.0	6	7,878	18,734.2
April	1	2,600	4,275.0	3	5,967	8,368.8
May	2	7,800	(1)	2	4,950	(1)
June	2	1,950	(1)	2	1,050	(1)
July	3	5,000	7,425.0	6	3,639	4,265.1
August	1	2,100	(1)	2	850	(1)
September	1	1,300	1,383.3	4	3,583	3,883.3
October	1	16,800	16,862.5	3	8,533	8,279.2
November	2	4,750	5,006.3	5	4,540	5,246.3
December	1	6,400	4,725.0	1	5,000	2,975.0
Average		7,509	9,866.83		6,277	8,494.8

[1] No record.

Tomato (*Lycopersicum esculentum*)

Work with tomatoes was not carried on long enough to justify the reaching of definite conclusion. Nevertheless, the results obtained indicate that certain varieties of tomato can be profitably grown provided they are planted at the right season of the year. Of the several varieties of tomatoes tested, two—Cristobal and the Hawaiian hybrid—seem best adapted to Guam conditions. Both varieties are prolific bearers.

Time of planting tests.—Plantings made about the end of the rainy season and before severe drought started, or from September to January, gave the best results. This period is the coolest of the year, a fact which probably largely accounts for the successful plantings. When made during the time of heavy rains, plantings were failures. Production varies largely with the seasons as well as with varieties. Yields have varied from 150 to 28,825 pounds per acre.

Tests of fertilizers.—Tomatoes did not respond to regular applications of fertilizer as well as did some of the other vegetables. The market value of the tomato is enhanced, however, by the use of fertilizers, and compensates for their use if they are applied judiciously. The Cristobal variety was increased 3,762.5 pounds per acre by treating with fertilizer, whereas the Uba[4] was increased only 630 pounds per acre. Table 31 gives the results of comparative tests on fertilized and unfertilized plats.

TABLE 31.—*Effect of fertilizers on yield of tomatoes*

Variety	Number of tests	Fertilized area		Unfertilized area	
		Number of tomatoes	Weight of tomatoes	Number of tomatoes	Weight of tomatoes
			Pounds		*Pounds*
Cristobal	4	295,600	26,409.38	227,400	22,646.88
Uba	2	----------	10,255.00	----------	9,625.00
Yellow Cherry	1	----------	2,313.50	----------	1,612.50

TURNIP (*Brassica rapa*)

Turnips are not successfully grown at all times. In 18 plantings made on unfertilized land, only 10 were successful. These 10 made an average yield of 60,020 turnips weighing 6,628.1 pounds per acre. In three comparative tests, the average for the fertilized plats was 61,700 turnips weighing 7,668.75 pounds, and for the unfertilized plats, 44,171 turnips weighing 5,500.3 pounds per acre.

WATERMELONS (*Citrullus vulgaris*)

Watermelons grow well during the whole year in Guam if irrigated during the dry season. During the rainy season an excellent growth of vines is obtained, but nearly all the melons that set rot before reaching a size larger than 4 inches in diameter. Yields are not high, but the quality of melon produced is generally very satisfactory and individual melons of good texture and flavor often weigh 50 pounds. The average weight of melons from unfertilized plats was, however, 12.5 pounds each, and from fertilized plats, 17.8 pounds each. In 16 tests that were completed during the years 1919 and 1920, the average yield for each test on unfertilized soil was 2,456 melons weighing 30,443.3 pounds per acre. Five fertilized plats each averaged 4,766 melons weighing 83,266.9 pounds per acre. Plantings made from October to March, inclusive, are generally successful. When planted at this time the watermelons fruit from February to July. Plantings made in other months may be equally as successful as those made from October to March provided that favorable locations are

[4] The Chamorro word "uba," taken from the Spanish "uva," meaning "grape," was given to this variety because of its small size.

selected. Table 32 shows the effect of time of planting and fertilizers on yield of watermelons when planted on low land.

TABLE 32.—*Effect of time of planting on yield of fertilized and unfertilized watermelons*

Month planted	Fertilized area			Unfertilized area		
	Number of tests	Number of watermelons per acre	Weight of watermelons per acre	Number of tests	Number of watermelons per acre	Weight of watermelons per acre
			Pounds			*Pounds*
January	2	5,900	137,075.0	3	4,156	59,274.4
February	1	1,800	19,400.0	2	1,334	22,114.6
March				2	1,434	8,843.8
April				1		
May	1			2		
June	1			1		
July	1			2	150	540.8
August	1			1		
September	1			3		
October	1			4	1,084	11,715.6
November	1	6,600	60,837.5	3	4,400	48,765.0
December	1	3,630	61,946.8	1	3,367	53,103.8

SUMMARY

Unsuccessful attempts to grow vegetables in Guam are attributed to planting at the wrong time, or to failure to apply the proper fertilizers at the right time.

Most of the common vegetables of Guam grow to some extent during any part of the year, but they do better in some months than in others.

In nearly all of the station tests plantings made during the extremely dry season or during periods of excessive rain failed.

A soil that is not naturally fertile can be made so by the addition of fertilizer, the increased yield from which should be more than enough to pay for its cost.

May, February, December, and March, in the order named, are considered most favorable for planting Kentucky Wonder beans on unfertilized land; and October, May, March, and November on fertilized land. Fertilizers were found to increase very materially the yield of string beans in nearly all tests.

The most favorable months for planting the Lima bean on unfertilized land were October, November, June, and September, in the order named; and on fertilized land, October, December, November, and June. The quantity and kind of fertilizer required for Lima beans depend upon the needs of the soil, which may vary for the different farms.

The station does not recommend the planting of the Pencil Pod Black Wax bean unless it is desired for home consumption.

The highest yields of fijole on both fertilized and unfertilized soil were obtained from plantings made in November.

In three tests made at the station, the seguidilla averaged 178 days from time of planting to first harvest. The long time it requires to produce seed is probably its greatest drawback.

The yields of beets on the regularly fertilized soil were more than 60 per cent higher than they were on the unfertilized land.

The most favorable months for planting carrots, on unfertilized land, were, in the order named, November, October, September, and August, and on fertilized plats, October, November, August, and December.

Cucumbers made heavy yields of fine quality when they were planted at the beginning of the rainy season. On fertilized plats the best months for planting were, in descending order of yields, May, August, June, and December, and on unfertilized plats, December, April, May, and June. Fertilized plats yielded more than twice as much as unfertilized plats.

Eggplants may be successfully planted at any time of the year except during the extremely dry season. Plantings made in November gave the highest yields, followed in order by those made in August, January, and September.

The highest yields of lettuce were obtained from plantings made during the season of plenty of moisture and cool temperatures, from November to March. Lettuce readily responded to applications of fertilizer and produced a better quality of leaf on fertilized than on unfertilized soil.

Muskmelons gave the highest yields when planted after the rainy season was well over.

The highest yields of mustard were obtained from plantings made in April, followed in order by those of May, June, and September. Fertilized soil gave a slightly larger yield and much better quality of leaf than did unfertilized soil.

Plantings of okra made in September and July gave the highest yields.

Onion sets planted about a foot apart yielded 9,300 onions on fertilized plats and 8,800 on the unfertilized plats.

Plantings of pepino made in March, April, June, and July gave larger yields than those made in other months.

The highest yields of peppers were obtained from plantings made in February. Fertilizers were found to benefit peppers, increasing the size and yields of the fruit and improving its quality. Shading the plats with coconut leaves placed on frames more than doubled the yield.

May was one of the best months in which to plant radishes, on both fertilized and unfertilized soil.

Squashes yielded best when planted in March, January, and October on fertilized soil and in March, February, and January on unfertilized soil.

Plantings of tomatoes from September to January gave the best results.

Turnips were not always a success. Only 10 of 18 plantings made on unfertilized land were successfully grown.

Plantings of watermelon from October to March, inclusive, were generally successful. Watermelons grew well during the whole year if they were given irrigation in the dry season.

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